east side, tearing two barns to pieces, also taking off of foundations two other barns. It then moved to the very northeasterly side of Carbondale, Pa., and tore to pieces one more barn. The path of destruction was about one and three-quarter to two miles in length and about 25 to 200 feet in width. One mile south of Simpson, Pa., the cloud was white, resembling steam somewhat, the top of the cloud being very dark, funnel-shaped, turning backward, or to fully illustrate, it was turning the same way you would turn a brace and bit if you were turning it out or backwards. The electric flashes issued from the funnel cloud. No hail at all, and only a few large drops of water. The noise was very peculiar, sounding like large quantities of water slashing and splashing, and also a heavy rumbling noise. Uprooted trees fell mostly toward the east. No persons or animals killed by the storm. No hail reported at any place in the vicinity."

MOHN'S RESULTS OF NANSEN'S NORTH POLAR WORK.

The results of the Norwegian North Polar Expedition of 1893–1896 organized and led by Fridtjof Nansen are being published in a series of handsome quarto volumes at the expense of the "Fridtjof Nansen Fund for the Advancement of Science." This fund is said to be essentially the money derived by Nansen from his numerous popular lectures in America and Europe and therefore analogous to the "Tyndall Fund" in the United States.

Volume 6 of the series is devoted to meteorology which is considered as No. XVII of the classified list of subjects under which Nansen's scientific observations are being studied. The magnetic, hydrographic, and biological work will undoubtedly be as interesting, if not as important, as the meteorological work. The latter was pecularily favored by the long imprisonment of the *Fram* in the ice, so that we have three years of observation under practically uniform conditions. The observations were carried out with indefatigable industry and faithfulness by Nansen's sailing captain, Sigurd Scott-Hansen, and his assistants, Capt. Hjalmar Johansen and Mr. Bernard Nordahl.

Technical meteorologists will especially appreciate the fact that the material accumulated on this voyage has been prepared for publication and in every respect admirably discussed by Prof. H. Mohn, the eminent director of the meteorological service of Norway. In addition to atmospheric observations proper, hydrography was also included in the scheme of work and the temperature of the sea surface in the open sea, and of the ice at different depths are fully recorded. The temperature of the sea water belongs to volume 3, but the temperature of the polar ice is properly considered as belonging to the meteorological data of volume 6. The journal of observations occupies 225 pages of this volume and is followed by about 400 pages of results, subdivided into chapters on the winds, pressure, temperature, moisture, clouds, precipitation, and fog, and optical phenomena. These are followed by chapters on the general relations of the observations made on the *Fram* to the general distribution of the temperature of the polar ice, the arctic areas of pressure and temperature, the diurnal and annual periods of meteorological elements in the arctic circumpolar sea.

The polar charts of the isotherms, isobars, and isabnormal lines for each month of the year for the Arctic region north of latitude 60° are based upon all data given by polar explorers and therefore replace the older preliminary efforts in that line of study. The chart showing the annual range of air temperature indicates four centers of maximum range, viz, central northern Siberia, central North America, central northern Greenland, and Lapland, where the annual ranges are respectively 66°, 45°, 40°, and 30° centigrade. The hypothetical annual range at the pole itself is 42° and this polar value would doubtless be included within the central north Greenland area whose maximum is 40° if we had a longer series of observations.

The charts of isobars show that the pressure at the pole itself will vary between 762.5 mm. in January, February, March, and April, and 759.0 mm. in June, July, August, and September.

The charts of isotherms show that the mean polar temperature is about —40° C. in January and February, 0° C. in July, —38° in December. The isabnormal line 0° necessarily passes through the pole in each month of the year, the warmer region is on the Atlantic side of the zero isabnormal throughout the year and the colder region lies toward Bering Strait, Alaska, and eastern Siberia also throughout the year.

The annual isotherms show an average temperature of —20° C. throughout the interior of Greenland and the central part of the arctic ice region extending to 15° from the pole toward Bering Strait.

Professor Mohn very properly states that the point of most importance in this whole series of observations is the fact that the surface of the earth during the whole time was of a unique homogeneous nature consisting of a level of frozen water with an uninterrupted free horizon. The distance from continents or islands was always considerable; although there was a change in latitude and longitude, yet the environment of the *Fram* was always so similar that the factors having an influence upon the climate may be regarded as a function mainly of the latitude and only slightly of the longitude. The entire drift of the *Fram* from August, 1893, to April, 1898, included three periods of about four months each of continuous night and also three periods of about four and a half months each of continuous day. These alternations, of course, gave abundant opportunity for distinguishing between the effects of sunshine and terrestrial radiation. In discussing the individual elements, winds, pressure, etc., certain anomalies were discovered as to diurnal and annual periods which could only be elucidated by a consideration of the atmospheric conditions in the whole Arctic region.

Professor Mohn states that the great distance between the *Fram* and any permanent or temporary meteorological station made it quite impossible to construct daily synoptic weather charts by means of which to study the influence of moving cyclonic and anticyclonic systems. He has however utilized the observations on the *Fram* in the light of our knowledge of the laws of cyclonic motion taking account of the coefficient of friction deduced from European observations and has tabulated the resulting computed bearings of the centers of low pressure and their motions. During three years the *Fram* came within the sphere of influence of at least as many as 73 moving areas of low pressure. The maximum number being in January and the minimum in June. The average duration of the passage of a depression was about four days. The lowest pressures at the *Fram* station during the passage, of a depression varied from 771.7 mm., which was the highest, to 724.1 mm., which was the lowest, and both occurred in February. The average heights of the low pressure were a little higher in winter than in summer, which is of course quite a contrast to our experience in the United States, but as the *Fram* was not generally at the center of a low pressure this can only be an approximation to the true average low pressure. There were, however, ten cases in which the center passed over the vessel. Of these the three lowest pressures were 726.0 mm., 727.3 mm., and 728.2 mm. The velocity of the wind observed during the passage of these depressions was not great. The highest being 18 meters per second, or about 40 miles per hour. The average velocity for the whole drift was 4.5 meters per second or 10 miles per hour. Judging from these velocities of the wind the track of the *Fram* can not be considered as a very stormy one. The centers of the depressions moved mostly toward the east-northeast and generally between southeast and northeast, but occasional tracks were toward each point of the compass. There was a preponderance of tracks on the westerly side of the *Fram*. During the first winter they lay chiefly north of the *Fram*, and in the last winter they were south of the *Fram*, so that the general mean direction of the tracks for latitude 82° north and longitudes between 20° east and 140° east is nearly due east.

On page 586 Mohn has made an interesting computation, which he requests us to look upon as a mere experiment, in which he attempts to deduce a connection between the rate of movement of a barometric minimum as a whole and the wind velocity and barometric gradient. From this calculation he concludes that we should expect a rate of 12 or 15 meters per second, or 647 to 809 miles per day, for the centers of low areas in the Arctic Ocean. On page 588 Mohn gives an elaborate mathematical study of the peculiarities of the diurnal and annual periods of the meteorological elements in the arctic circumpolar sea. The main factor to be considered is the heat received by radiation from the sun, and the amount of this heat he computes in detail month by month, as also the sum total of the radiation from the sky and the loss of heat by radiation, utilizing the previous computations of Maurer and Angot. Mohn's effort to compute these quantities is ingenious and suggestive, and will undoubtedly stimulate others to publish analogous computations that have been made. He is quite right in saying that the diurnal variation of the total radiation effect is the chief factor that determines the periods of the various meteorological elements. The principal meteorological effect of the radiation from the sun and sky above us is the heating of the atmosphere and of the surface of the earth. The radiation of heat from the surface of the earth is always going on, but must vary with the cloudiness or clearness of the sky. With an overcast sky the radiation from above is screened off, and the radiation from below is radiated back to the surface of the earth. The radiation from the twilight sky has an appreciable heating power, and acts as a "heat twilight," as it is called by Dove.

During the long winter night, when the sun's rays do not strike the earth or the ice in the neighborhood of the *Fram*, they do, however, pass through the atmosphere at some distance above sea level, and even when they make a scarcely perceptible twilight they are still effective in warming up incipient precipitation at great altitudes and in maintaining a clear atmosphere with a blue black sky where there would otherwise be a slight haze. Radiation takes place more easily through such a clear sky. Consequently the local temperature has a tendency to fall during arctic winters when the sun is near the meridian, and this is clearly brought out by Mohn's computations. Therefore, we may say that the diurnal periodicity of temperature during clear days in midwinter is inverse to the diurnal period during such days in midsummer. This minimum of temperature during the winter twilight is entirely analogous to the minimum that occurs in temperate zones in the early morning twilight, and even sometimes after sunrise on the clearest days at high altitudes.

The diurnal period in the velocity of the wind is due to this diurnal period in the resulting radiation effect, and the observations of wind and radiation harmonize therewith, but the annual period of the velocity of the wind does not seem to depend on the annual period of the total radiation, as other factors become important, such as the extent of the areas of cloud and fog, the annual change of the general circulation of the atmosphere, the annual change in the distribution of vertical temperature gradients. Mohn especially calls attention to the need of careful anemometric observations in the polar regions at the topmast for comparison with those near sea level.

The diurnal variation of vapor tension is distinctly shown by the observations. There is one maximum after noon and one minimum late at night. "The diurnal ascending currents are too weak to carry the vapor upwards at a rate sufficient to produce a secondary minimum at the warmest time of the day." On the other hand the diurnal period of the amount of cloud is also distinct, there being a greater amount in the daytime than in the nighttime, so that the diurnal ascending currents must be strong enough to produce this diurnal period in the cloudiness. The probability of precipitation is greater in the daytime than during the nighttime.

METEOROLOGY IN SOUTH AMERICA.

CHILE.

Referring to an article under the title Meteorology in Chile, that will be found on page 326 of the MONTHLY WEATHER REVIEW for 1904, we are informed that meteorological work in Chile, after being for a long time divided between the national Astronomical Observatory at Santiago and the Central Meteorological Office connected with the Navy Department of the Republic of Chile, has now been subdivided and will hereafter be carried on by the following institutions:

1. "The Hydrographic Office of the Navy Department, at Valparaiso," which will have charge of ocean meteorology.
2. "The Section of Meteorology of the Administration of the Maritime District, Valparaiso," which controls the light-house stations of Chile and takes the place of the former Central Office at Santiago; it will have charge of coastal meteorology.
3. "The Section of Meteorology of the Astronomical Observatory of Santiago," which has charge of the meteorological stations established in the public schools in the provinces. The observatory will doubtless also have charge of higher scientific research in meteorology.
4. "The Weather Office connected with the Agricultural School of Santiago," which is under the Ministry of Industry. This weather office was established for the study of climate and meteorology in their relations to agricultural industries. This office issues a daily weather map based on observations taken at 4 p. m., Santiago time. It is expected that a special system of observations at 12 noon, Greenwich time, will soon be organized, and that a monthly bulletin will be published.

While this subdivision will give opportunity for the development of the scientific ability of many officials, yet it may also lead to a diversity of methods, and to a dissipation of energy and money that may not redound to the advantage of meteorology.

It would seem that while stimulating individual ability, the citizens of the Republic of Chile may lose the advantages that flow from the recognition of some central authority. Thus we find meteorological observers in that country writing to the Weather Bureau of the United States asking for the privilege of cooperating with it, whereas the true interests of meteorology would require the most hearty cooperation among themselves and with the excellent services in the adjoining countries, Peru, Brazil, and Argentine Republic.

Whatever may be the political, local, or commercial jealousies that prevade neighboring countries there can be no doubt that meteorology demands the most perfect scientific harmony; its field is the world. All in North and South America who would advance the study may well profit by the experience of meteorologists in Europe, where climatological observations and daily telegrams are neutral matters so far as they are affected by ordinary military conditions, and where international conventions labor to bring about perfect conformity with the present state of physical science.—*C. A.*

Mr. Lucio Alonso Villalobos, a wealthy merchant of Iquique, Chile, informs the Chief of the U. S. Weather Bureau that he has ordered meteorological apparatus from Europe and magnetic apparatus from Shanghai, China, and intends to establish "the best observatory in South America." He con-